ECONOMIC IMPACTS OF THE TAX REFORM ACT OF 1986: SHORT-RUN AND LONG-RUN PERSPECTIVES

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PREFACE

This paper was written by Frederick Ribe while he was employed at the Congressional Budget Office. It was undertaken as technical background work in connection with ongoing studies of the Tax Reform Act of 1986.

The author wishes to thank William Beeman, Edward Gramlich, Robert Hartman, Yolanda Henderson, Rudolph Penner, George Perry, Leonard Sahling, Matthew Salomon, and Eric Toder for helpful comments. Rae L. Roy prepared the manuscript for publication.

Edward Gramlich
Acting Director

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SUMMARY

What effect will the Tax Reform Act of 1986 have on the United States' economy? Will it slow the economic expansion or help it along? Will it raise interest rates? What will be the long-run economic benefits of the act, and how important are they likely to be? This study provides detailed analysis of these questions.

SHORT-TERM IMPACTS OF THE TAX REFORM ACT

The paper's estimates of the effects of tax reform over the period 1986-1988 are computed using three small short-run econometric models developed by the author. These models measure the effects of changes in tax provisions on demand in each important sector of the economy. Because these are simultaneous models, the results show not only the direct effects of tax reform on each sector, but also interactions among sectors, and multiplier effects.

The three models differ only in their treatment of business fixed investment: because there is still a great deal of controversy over the correct way to model that sector, this study used three separate approaches imputing varying degrees of sensitivity with respect to tax provisions for business investment. The results from the three models are shown in Summary Tables 1-3.

The most important short-run results are that:

- There is a risk that business fixed investment could be reduced sharply, though temporarily, by the business provisions of the Tax Reform Act. According to one investment model used in this study, the cutback in investment could reach a peak of about 1½ percent of GNP during mid-1987, but the reduction would fade steadily after that.

- Uncertainty over the behavior of business investment suggests that tax reform could have a range of possible effects on the strength of the economic expansion. According to the estimates

in this study, the effect during 1986 and 1987 is likely to be (or have been) at least slightly negative, with the estimates of the effect on the 1987 growth rate of real GNP ranging between -0.05 percentage point and -1.0 percentage point. The negative effects should have worn off by late 1988, however, so that by the end of that year the estimates of the effects on the growth rate of real GNP range from 0.0 percentage point to +0.3 percentage point.

- Housing investment is likely to be reduced over the entire forecast period, with the reduction amounting to as much as 0.5 percent of GNP during 1988. The reduction is likely to be concentrated among multiple-family structures, which are especially hard hit by the Tax Reform Act's scaling back of tax benefits to tax shelterers and other business investors in structures. Investment in single-family housing is likely to be affected positively, if at all.

- Sales of consumer durable goods such as automobiles are likely to be affected positively, in the same way as single-family housing. While the reduction in marginal tax rates and the withdrawal of deductions for sales taxes and some consumer interest obligations will all make purchasing these goods more expensive, this negative effect will be more than offset by the positive impact of the increases in after-tax income that are promised to households as a group by the tax reform.

- Interest rates are likely to be reduced very slightly--perhaps a tenth of a percentage point--by the effects of the tax reform act in the near term. The range of estimated changes in market rates attributable to the act is from zero to -0.2 percentage point in 1987, and is effectively zero in 1988.

LONG-TERM EFFECTS OF THE TAX REFORM ACT

Apart from its impact during the first few years after enactment, the Tax Reform Act can be expected to have effects that are felt only after several years at least. Although there are several aspects to the long- run economic improvements promised by the act, among the most important is its effect in making the tax code more "neutral" with respect to different types of capital--that is, subjecting different types to effective tax rates that are more nearly equal than under the previous law. This implies that the capital stock should be more productive than before.

This study develops estimates of the output gain from greater tax neutrality using a neoclassical growth model that recognizes five different types of productive capital and the associated effective tax rates. The estimates suggest an output gain from improved neutrality of about 0.1 percent of the economy's present potential output. While this figure appears small, it is consistent with those in other studies. Even at that, the estimate may be overstated because it takes no account of an important nonneutrality that is preserved by the Tax Reform Act: the relatively low effective tax rate on the large stock of owner-occupied housing.

The estimates in the paper were made with an open-economy growth model that takes account of the possibility that some financial capital will stop flowing into--or actually begin flowing out of--the United States in response to changes in taxation and consequent changes in U. S. interest rates. Though the model suggests a net capital outflow in response to the tax reform, this has only a very slight effect on gross domestic product (GDP)--about 0.01 percent of present GNP. The effect on gross national product (GNP) is even smaller.

SUMMARY TABLE 1. ESTIMATED OVERALL ECONOMIC IMPACTS OF TAX REFORM USING ACCELERATOR INVESTMENT EQUATIONS (In percent of baseline real GNP unless otherwise noted)

Quarter	GNP	Int [a/]	Cons	Cars	OCD	Hous	PDE	NRST	Imp
1986:1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987:1	0.1	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.0
1987:2	0.0	0.0	0.1	0.0	0.0	-0.2	0.0	0.0	0.0
1987:3	-0.1	0.0	0.1	0.0	0.0	-0.3	0.0	0.0	0.0
1987:4	-0.2	0.0	0.1	0.0	0.0	-0.4	0.0	0.0	0.0
1988:1	0.2	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:2	0.3	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:3	0.3	0.1	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:4	0.3	0.1	0.4	0.1	0.1	-0.3	0.1	0.0	0.0

SOURCE: Author's estimates described in text.

a. Percentage points.

Details may not add to totals because of rounding.

"GNP" is gross national product.
"Int" is the interest rate (91-day Treasury bill rate).
"Cons" is spending for nondurable consumption.
"Cars" is consumer spending for automobiles and parts.
"OCD" is consumer spending for durable goods other than autos and parts.
"Hous" is residential investment.
"PDE" is investment in producers' durable equipment.
"NRST" is investment in nonresidential structures.
"Imp" is imports of goods and services.

SUMMARY TABLE 2. ESTIMATED OVERALL ECONOMIC IMPACTS OF TAX REFORM USING PUTTY-CLAY INVESTMENT EQUATIONS (In percent of baseline real GNP unless otherwise noted)

Quarter	GNP	Int [a/]	Cons	Cars	OCD	Hous	PDE	NRST	Imp
1986:1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987:1	0.1	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.0
1987:2	0.0	0.0	0.1	0.0	0.0	-0.2	0.0	0.0	0.0
1987:3	-0.1	0.0	0.1	0.0	0.0	-0.3	0.0	0.0	0.0
1987:4	-0.2	0.0	0.1	0.0	0.0	-0.4	0.0	0.0	0.0
1988:1	0.2	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:2	0.2	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:3	0.2	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:4	0.2	0.0	0.4	0.1	0.1	-0.3	0.1	0.0	0.0

SOURCE: Author's estimates described in text.

a. Percentage points.

Details may not add to totals because of rounding.

"GNP" is gross national product.
"Int" is the interest rate (91-day Treasury bill rate).
"Cons" is spending for nondurable consumption.
"Cars" is consumer spending for automobiles and parts.
"OCD" is consumer spending for durable goods other than autos and parts.
"Hous" is residential investment.
"PDE" is investment in producers' durable equipment.
"NRST" is investment in nonresidential structures.
"Imp" is imports of goods and services.

SUMMARY TABLE 3. ESTIMATED OVERALL ECONOMIC IMPACTS OF TAX REFORM USING PUTTY-PUTTY INVESTMENT EQUATIONS (In percent of baseline real GNP unless otherwise noted)

Quarter	GNP	Int [a]	Cons	Cars	OCD	Hous	PDE	NRST	Imp
1986:1	-0.2	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0
1986:2	-0.6	-0.1	0.0	0.0	0.0	0.0	-0.6	0.0	0.0
1986:3	-0.8	-0.2	0.0	0.0	0.0	0.0	-0.9	0.0	0.0
1986:4	-0.9	-0.2	0.0	0.0	0.0	0.1	-1.1	0.0	-0.1
1987:1	-0.8	-0.2	0.1	0.0	0.0	0.0	-1.2	0.1	-0.1
1987:2	-0.9	-0.2	0.2	0.0	0.0	-0.1	-1.3	0.1	-0.1
1987:3	-1.1	-0.2	0.2	0.0	0.0	-0.2	-1.2	0.0	-0.1
1987:4	-1.0	-0.2	0.2	0.0	0.0	-0.3	-1.1	0.0	-0.1
1988:1	-0.5	-0.1	0.4	0.1	0.1	-0.3	-1.0	0.0	-0.1
1988:2	-0.3	-0.1	0.4	0.1	0.1	-0.3	-0.8	0.0	-0.1
1988:3	-0.2	0.0	0.4	0.1	0.1	-0.3	-0.6	0.0	-0.1
1988:4	0.0	0.0	0.4	0.1	0.1	-0.3	-0.4	0.0	-0.1

SOURCE: Author's estimates described in text.

a. Percentage points.

Details may not add to totals because of rounding.

"GNP" is gross national product.
"Int" is the interest rate (91-day Treasury bill rate).
"Cons" is spending for nondurable consumption.
"Cars" is consumer spending for automobiles and parts.
"OCD" is consumer spending for durable goods other than autos and parts.
"Hous" is residential investment.
"PDE" is investment in producers' durable equipment.
"NRST" is investment in nonresidential structures.
"Imp" is imports of goods and services.

SECTION I

INTRODUCTION

Popular discussion both before and since passage of the Tax Reform Act of 1986 has revealed a great deal of uncertainty over its likely economic effects. Predictions of the near-term impact turn mainly on differing views of the act's effects on fixed investment: some analysts expect a severe downturn in investment leading to a noticeable overall economic slowdown, while others foresee little effect. In the longer term, tax reform is expected to improve economic efficiency, but little information is available on the magnitudes of the potential improvement in output or of the other economic changes that maybe in prospect.

This paper presents model results regarding both the short-run and long-run effects of the Tax Reform Act. The short-run analysis adopts the Keynesian approach that is used in most other formal short-run studies of the effects of the act and is implicit in virtually all public discussion of this subject. 1/ The analysis in this study improves on others, however, in that it uses carefully chosen models to determine the impact of the tax change on demand in each important sector of the economy. In dealing with business investment, in particular, the paper uses three alternative models representing various schools of thought on the behavior of spending in this sector. What results is an estimate of the range of GNP effects that is implied by these alternative investment equations (in combination with the other sectoral equations).

The long-run discussion provides an analytic treatment of how the tax change should ultimately affect the economy, including in particular the increase in output that should result from the improvements in tax neutrality. Neoclassical growth models are then used to develop estimates of the long-run effects on output, interest rates, and the external trade balance. The quantitative analysis treats the U.S. as a large open economy, and thus represents the behavior of the rest of the world explicitly.

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1. Examples of formal studies of the short-run impact of the Tax Reform Act that use essentially the same procedures employed here are Chase Econometrics, "U.S. Macroeconomic Forecasts and Analysis," September 1986; and University of Michigan Research Seminar in Quantitative Economics, "The U.S. Economic Outlook for 1986-1987: October Forecast Update," October 9, 1986.

Major Features of Tax Reform

The Tax Reform Act of 1986 is a comprehensive change in the nation's income-tax laws that reduces income taxes for most individuals, shifting much of this burden to corporations. Those features of the act that play a central role in the analysis in this paper will be summarized here. 2/

The act provides reductions for individual taxpayers in both the number and the level of the tax rates that apply to income after all deductions and exemptions have been taken. The number of rates is reduced from 15 to 5, and their level is reduced effective January 1, 1987. The top rate, for example, falls from 50 percent before 1987 to 38.5 percent in that year. In 1988, the rates are reduced and simplified again, with the number falling effectively to three, the highest of which is 33 percent. At the same time, however, individual taxpayers face the reduction or elimination of many deductions, such as those for consumer interest and state and local sales taxes. The deductibility of contributions to Individual Retirement Accounts is limited to lower-income individuals and those without access to employer-provided pension plans. The exclusion of 60 percent of long-term capital gains from taxable income under prior law is repealed. There is a stronger alternative minimum tax, and limits are placed on the extent to which "passive" losses (tax losses taken principally by limited partners in real-estate or other ventures) can be offset against income other than that from similar sources. Many of the changes in the definition of taxable income became effective on January 1, 1987.

A parallel set of changes affects corporations and businesses generally, although the overall result is to increase the tax burden on business income. Prominent among these features are the repeal of the investment tax credit, and an overall lengthening of useful lives for depreciation of fixed investments. Less accelerated methods of depreciation were prescribed for structures. Except for the repeal of the investment tax credit, which was effective at the beginning of 1986, these changes generally take effect at the beginning of 1987. The tax rates that apply to taxable corporate profits are also reduced effective July 1, 1987, with the top rate falling from 46 to 34 percent.

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2. For a more detailed account, see U.S. House of Representatives Report 99-841, *Tax Reform Act of 1986: Conference Report to accompany H.R. 3838* (U.S. Government Printing Office, September 18, 1986).

SECTION II

SHORT-RUN ECONOMIC IMPACTS OF THE TAX REFORM ACT OF 1986

The analysis in this section follows standard textbook principles of short-run macroeconomic analysis. Indeed, the model in this section is methodologically quite similar to most large-scale short-run macroeconometric models. The most important defining assumption used in this short-run analysis is that the aggregate capital stock is constant. The rationale for this assumption is that cumulative net investment flows over the typical short-run horizon of one to five years are typically too small in relation to the existing stock of capital to represent significant changes in it. For much the same reason, components of the stock of physical capital and most financial stocks--for example, the stocks of interest-bearing government debt and of claims on other countries--are assumed fixed over the short run as well. 3/ While not a necessary corollary of the assumption of unchanged capital stocks, it is usually assumed in short-run analyses that relative prices are unchanged as well.

Organization of the Section

The first part of this section is a discussion of the likely direct short-run impacts of the Tax Reform Act on business investment, residential investment, spending on consumer durables, nondurable consumption, net exports, interest rates, labor supply, and prices. Econometric equations are

3. One consequence of the assumption of fixity of all categories of physical capital that is important in the analysis is this one: when an increase in the taxation of the income from capital occurs (as it does in the case of the Tax Reform Act), the assumption of short- run capital fixity means that the tax falls on savers in the short run. For this reason, flows of dividends are assumed in the analysis below to be reduced by the full amount of the increase in corporate tax liabilities that is caused by the Tax Reform Act. However, the short-run analysis recognizes that the supply of capital to corporations will respond to the tax change in the long run in such a way as to pass at least some of the tax increase forward in the form of higher capital costs, and that investment will begin responding to this development in the short run. Thus the short-run analysis models investment flows on the basis of long-run measures of the cost of capital while at the same time making the seemingly inconsistent assumption that savers bear the full tax increase in the short run.

developed for modeling the effects on each spending category and on interest rates. These direct effects are calculated using these equations and presented at the end of this section in tabular form.

These calculations of the direct impacts on each sector take no account of indirect effects stemming from effects in other sectors. For example, investment in housing may be reduced by the increase in the user cost of residential investment resulting directly from the tax change, but it may be increased if the impacts in other sectors generate an increase in aggregate demand, in output, and hence in income for potential buyers of housing. Such indirect effects are not discussed in the sector-by-sector discussion in the first part of this section of the paper, primarily because they are too numerous and complicated to take into account completely. However, the indirect effects, together with other "multiplier" effects on demand in each sector, are calculated in the simulations of the full simultaneous econometric model made up of the collected sector-by-sector equations (together with a number of identities shown in the appendix). These full-model results are shown toward the end of the section in separate tables accompanying those showing the indirect effects.

DISCUSSION OF THE SHORT-RUN EFFECTS

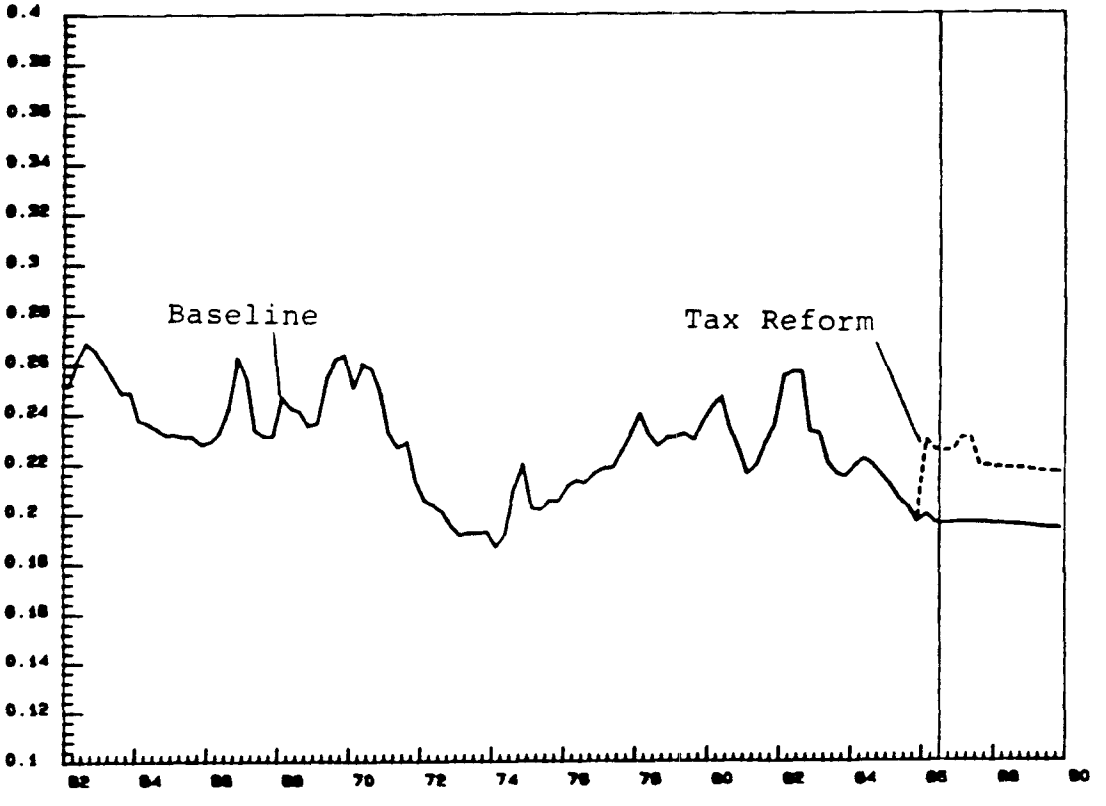
Effects on Business Fixed Investment

As this discussion has already mentioned, the Tax Reform Act entails a number of provisions that increase the effective tax rate on business capital. The increases in the effective marginal tax rate are reflected in significant increases in the user cost of capital. This is shown in Figures 1 and 2, which respectively show current estimates of the user costs for producers' durable equipment and for nonresidential structures since 1962, together with forecasts over the 1986-1989 period, with and without the changes implied by the act. 4/

4. These estimates were developed using the CBO user-cost model. This model incorporates a specification that differs only slightly from that originally put forward by Robert Hall and Dale W. Jorgenson, "Tax Policy and Investment Behavior," *American Economic Review* (June 1967), pp. 391-414. User costs are computed separately for each of the 21 categories of equipment and 10 categories of nonresidential structures in the National Income and Product Accounts, and then aggregated using weights reflecting relative stocks. The model uses estimates of economic depreciation rates from Charles R. Hulten and Frank C. Wyckoff, "The Measurement of Economic Depreciation," in C.R. Hulten, ed., *Depreciation, Inflation, and the Taxation of Income from Capital* (Washington, D.C.: Urban Institute, 1981). The measure of the real cost of capital is similar to that in the

Figure 1.

User Cost for Producers' Durable Equipment



SOURCE: Congressional Budget Office.

As Figure 1 shows, the increase in the cost measure caused by tax reform is especially sharp for producers' durable equipment, owing to the repeal of the investment tax credit effective retroactively to the beginning of 1986. The cost rises slightly more in early 1987 when depreciation deductions for equipment are scaled back, and then falls somewhat in mid-1987 when the statutory marginal corporate tax rate is reduced from 46 percent to 34 percent. The reduction in the tax rate reduces the user cost because of its strong effect in increasing the expected after-tax return to capital. This effect is sharp enough in these cases to dominate another that works in the opposite direction--the effect of the rate cut in reducing the value of the deductions for depreciation and interest.

The user cost for nonresidential structures owned by corporations, shown in Figure 2, rises very slightly in early 1986 with the repeal of the investment tax credit. The increase is not sharp because most structures were already ineligible for the credit. A sharper increase in the cost comes in early 1987 when depreciation deductions for structures are scaled back. The user cost falls nearly to its baseline level with the reduction in the statutory tax rate in mid-1987. 5/

The timing of the user-cost reductions entailed by the fall in the statutory tax rate is open to question. The figures shown here put the reduction at the same time that the reduction is made effective, in mid-1987, but much of its effect may have been felt earlier. This is because the user-cost-reducing effect comes about through increases in the expected after-tax return to investment, which may have increased as soon as such a rate cut became a matter of probability, perhaps in early 1986.

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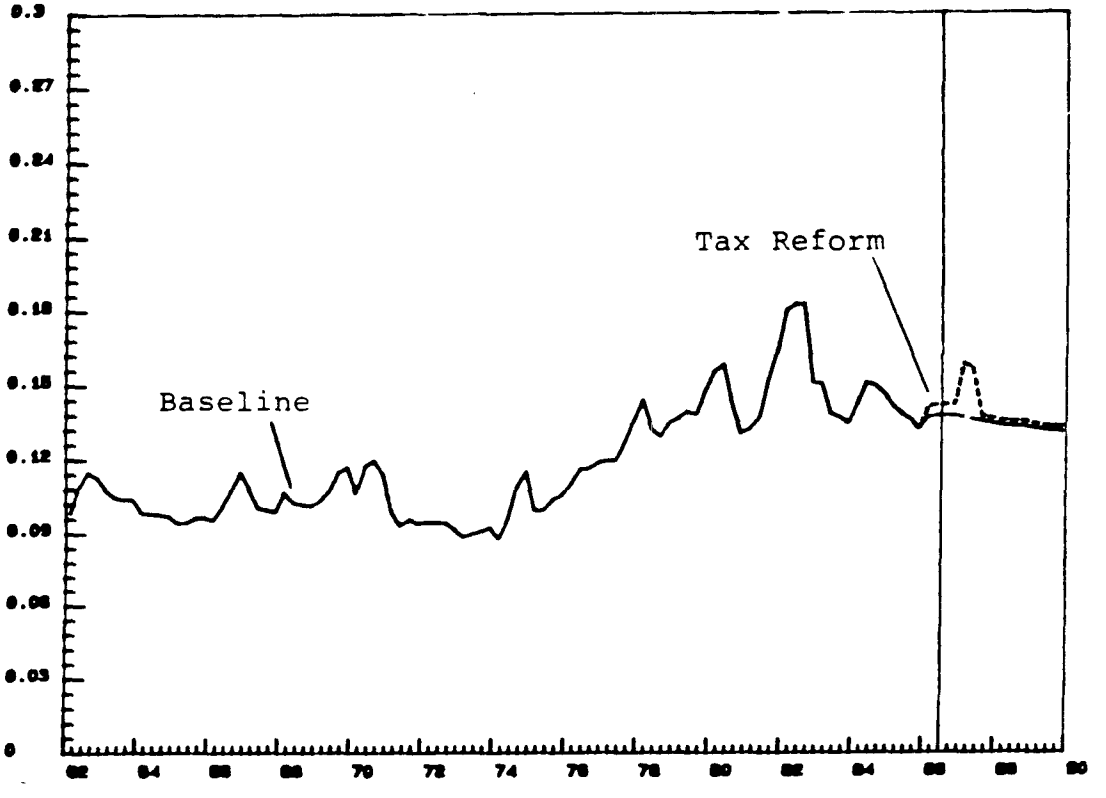
4. Continued
MPS econometric model, in that it is based on a weighted average of the real after-tax interest rate and the yield on equity, represented as twice the dividend/price ratio. (For further explanation, see Flint Brayton and Eileen Mauskopf, *The MPS Model of the United States Economy* (Washington, D.C.: Board of Governors of the Federal Reserve System, 1985). Inflationary expectations are computed using a backward-looking mechanism applied to the GNP deflator. Streams of depreciation deductions are computed using algorithms for computing optimal deductions exactly, and are discounted using an after-tax nominal interest rate. For more information, see Congressional Budget Office, "The User Cost of Capital: An Update" (internal memorandum, October 20, 1986).

5. The behavior of the user cost for residential structures owned by corporations is quite similar to that of the measure for nonresidential structures shown in Figure 2.

Figure 2.

User Cost for Nonresidential Structures



SOURCE: Congressional Budget Office.

How Will These Tax Changes Affect Investment? The short-run effects of such tax changes on business investment have for 20 years been the subject of one of the more intense controversies in economics. Various competing theories of investment have been developed, some of which impute a role to tax factors and some of which do not.

Three such models are considered here. The first is the "simple accelerator" model (hereafter referred to as the "accelerator") associated mainly with Robert Eisner, an approach that imputes no direct investment effect to changes in user costs. The second model is the neoclassical "putty-putty" model of Dale Jorgenson. 6/ This approach assumes that the changes in relative factor costs that are implied by user-cost changes, ceteris paribus, give rise to adjustments in the labor intensity with which all capital, both new and old, is used. This implies relatively sharp investment impacts from user-cost changes. The third model considered is the"putty-clay" approach developed by Bischoff, in which it is assumed that changes in factor intensity can only be made in carrying out new investment. 7/ This view implies that changes in investment in response to changes in user costs are relatively gradual.

The specifications of all of these models are based on the assumption that the desired capital stock is related to (a distributed lag on) some observable variable(s), which, following Hall, will here be called "X". 8/ This implies that net investment is related to (a distributed lag on) the change in X, and that gross investment--the usual left-hand-side variable--is this distributed lag plus one or more lagged capital stock terms to measure depreciation.

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6. Dale W. Jorgenson, "Capital Theory and Investment Behavior," *American Economic Review*, vol 53 (May 1963), pp. 247-259.

7. Charles Bischoff, "Hypothesis Testing and the Demand for Capital Goods," *Review of Economics and Statistics*, vol 51 (August 1969), pp. 354-368, and later work.

8. The discussion that follows draws heavily on Robert Hall, "Investment, Interest Rates, and the Effects of Stabilization Policies," *Brookings Papers on Economic Activity*, 1977:1, pp. 61-121. The econometric work that is reported in this subsection was carried out by my CBO colleague Matthew Salomon, who also provided valuable discussion. As Hall points out, the distributed lag by which X is related to the desired capital stock reflects formation of expectations of permanentlevels of X. As a consequence, estimated lag coefficients like those reported below are potentially subject to the well-known criticism associated with Robert Lucas to the effect that estimates reflecting expectation formation may be unreliable if economic agents use rational expectations. See Robert E. Lucas, "Econometric Policy Evaluation: A Critique," *Journal of Monetary Economics*, Supplement, vol. 2 (1976). No attempt to deal with this issue is made in this subsection or elsewhere in the paper.

In the accelerator model a constant desired capital/output ratio is assumed, so X is simply output. Thus the right-hand side of the estimated investment equation consists of the lagged capital stock and a distributed lag on changes in output. The equations in the first lines of Tables 1a and 1b are examples.

The putty-putty model is derived assuming a Cobb-Douglas production function, which implies directly that the desired capital stock is a linear function of the ratio of output to the user cost. 9/ Hence, this ratio constitutes X in the putty-putty model. Moreover, no asymmetries in the potential investment effects of output and the user cost are recognized, so empirical putty-putty equations, like those in the second lines of Tables 1a and 1b, often consist simply of one or more lagged capital stock terms to pickup depreciation, plus a distributed lag on the change in the output/user cost ratio. The putty-putty model implies a relatively fast response of investment to a change in either output or the user cost, and necessarily imputes the same response pattern to a change in either variable.

The putty-clay approach also assumes that the output/user cost ratio indexes capital demand. In this case, however, the assumption of ex-post fixity in the capital/labor ratio embodied in installed capital implies that output and the user cost must be treated asymmetrically in the investment equation. Changes in output alone imply a need simply to add to (or subtract from) the existing capital stock, maintaining the current capital/labor ratio--something that can be done relatively quickly. Changes in the user cost, on the other hand, imply a need to alter the factor proportions embodied in the existing capital stock. This process can take a relatively long time under putty-clay assumptions, since the capital/labor ratio embodied in the existing capital stock can only be changed as this stock depreciates and is replaced. Empirical putty-clay equations therefore require more than one distributed lag in order to treat output and the user cost asymmetrically. For example, the specifications in the third lines of Tables 1a and 1b are of the form

$$I = A + B_i[(Y_t/c_t) - (Y_{t-1}/c_{t-1})(1-d)] + G_i[(Y_t/c_{t-1}) - (Y_{t-1}/c_{t-2})(1-d)]$$

where A and the B_i and G_i are estimated parameters and d is an economic depreciation rate estimated a priori. Unlike the putty-putty equation, this specification yields separate estimates of the effect of a change in output, Y, and of a change in the user cost, c.

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9. Expressing both capital, k, and output, y, in per-worker-hour terms, the Cobb-Douglas function is $y = k^a$, and the marginal product of capital is $mp = ak^{a-1} = ay/k$. Setting this equal to the user cost, c, and rearranging implies $k = ay/c$.

The estimates typically imply a much slower response to changes in the user cost than to changes in output, or to output or the user cost in the putty-putty estimates in Table 1.

Choosing Among Investment Models. Neither empirical nor theoretical reasoning yields a clear choice among these three investment models. Attempts to estimate neoclassical models are plagued by problems in measuring the user cost and by simultaneous-equations problems that are likely to bias their coefficients toward zero. Tests based on explanatory and/or predictive power typically favor the accelerator model. Among the equation estimates shown in Table 1, for example, the accelerator formulation explained both equipment and structures investment better than any other model, as Table 2 shows. 10/ Among the others, the putty-clay model ranked second in explaining equipment investment. All of the models did a poor job of predicting investment in nonresidential structures when no autocorrelation correction was used. When an autocorrelation correction was used, the relative ranking of the putty-putty and putty-clay models was reversed relative to the case of equipment investment.

Many economists nevertheless prefer the neoclassical approach to the accelerator on theoretical grounds. This is because varying factor proportions are clearly possible in the long run, and even casual inspection suggests that shifts in relative prices induce some cost-reducing changes in factor intensity. The effects of these long-run developments should be evident in short-run behavior as well.

There seems, however, to be no clear consensus in favor either of putty-putty or putty-clay as a short-run approach. This reflects, in part, the difficulty in judging the degree of ex-post substitutability that is afforded by such institutional possibilities as combining varying numbers of shifts of labor with a given amount of capital. 11/ In view of these ambiguities, this study uses the estimates in Table 1 of all three models as alternative measures of the investment impact of the Tax Reform Act.

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10. Earlier studies that arrived at similar conclusions were Peter K. Clark, "Investment in the 1970's: Theory, Peformance, and Prediction," *Brookings Papers on Economic Activity*, 1979:1, pp. 73-124; and Richard W. Kopcke, "The Behavior of Investment Spending During the Recession and Recovery," *New England Economic Review*(November-December 1977), pp. 5-41.

11. For a detailed discussion of these issues, see Robert Hall, op. cit., and the accompanying comments by Franco Modigliani,

TABLE I-A. ESTIMATED EQUATIONS FOR INVESTMENT IN PRODUCERS' DURABLE EQUIPMENT

Accelerator

$$Ipde = \underset{(5.054)}{-4.885} + \underset{(11.534)}{2.637}*[Y - Y_{t-1}] + \underset{(41.921)}{0.162}\,Kpde_{t-1}$$

R-bar2: .948 Durbin-Watson: 2.310
Sample period: 1953:1--1985:4
Estimated first-order autocorrelation coefficient:
* Variable is entered as 18-quarter distributed lag, fit to a third-degree polynomial with far endpoint constraint. Reported coefficient and t-statistic are for the sum of lag coefficients.

Putty-Clay

$$Ipde = \underset{(8.861)**}{-391.995}**[(Y/cpde)-(1-dpde)(Y_{t-1}/cpde_{t-1})] + \underset{(9.931)**}{409.941}**[(Y_{t-1}/cpde_{t-1})-(1-dpde)(Y-2/cpde_{t-1})]$$

R-bar2: .922 Durbin-Watson: 2.005
Sample period: 1961:3--1985:4
Estimated first-order autocorrelation coefficient: 0.848
** Variable is entered as 27-quarter distributed lag, fit to a third-degree polynomial with far endpoint constraint. Reported coefficient and t-statistic are for the sum of lag coefficients.

Putty-Putty

$$Ipde = \underset{(0.546)}{1.010} + \underset{(7.782)}{.156}\,Kpde_{t-1} + \underset{(0.325)*}{3.030}*[(Y/cpde) - (Yt\text{-}1/cpde_{t-1})]$$

R-bar2: .549 Durbin-Watson: 1.764
Sample period: 1960:2--1985:4
Estimated first-order autocorrelation coefficient: 0.932
* Variable is entered as 23-quarter distributed lag, fit to a third-degree polynomial with far endpoint constraint. Reported coefficient and t-statistic are for the sum of lag coefficients.

Definitions:

Ipde: investment in producers' durable equipment (MPS). a/
Kpde: net stock of producers' durable equipment (MPS).
Y: Gross corporate product (MPS).
cpde: Real user cost of capital for producers' durable equipment (cents per dollar) (MPS).
dpde: Real depreciation rate (estimated in putty-putty equation as 0.156).

NOTE: All variables are in billions of 1982 dollars unless otherwise specified. Numbers in parentheses below coefficient values are t-statistics.

a. MPS indictates MIT-Penn-Social Science Research Council model databank.

TABLE I-B. ESTIMATED EQUATIONS FOR INVESTMENT IN NONRESIDENTIAL STRUCTURES

Accelerator

$$Inrst = \underset{(1.076)}{-1.046} + \underset{(6.762)}{0.075\, Knrst_{t-1}} + \underset{(6.287)}{2.989^{*}\,[Y - Y_{t-1}]}$$

R-bar2: .517 Durbin-Watson: 1.687
Sample period: 1955:3--1985:4.
Estimated first-order autocorrelation coefficient:
* Variable is entered as 28-quarter distributed lag, fit to a third-degree polynomial with far endpoint constraint. Reported coefficient and t-statistic are for the sum of lag coefficients.

Putty-Clay

$$Inrst = \underset{(0.553)^{**}}{-12.331^{**}[(Y/cnrst)-(1-dnrst)(Y_{t-1}/cnrst_{t-1})]} + \underset{(1.145)^{**}}{25.305^{**}[(Y_{t-1}/cnrst_{t-1})-(1-dnrst)(Y_{t-2}/cnrst_{t-1})]}$$

R-bar2: .246 Durbin-Watson: 1.027
Sample period: 1965:4--1985:4
Estimated first-order autocorrelation coefficient: 0.923
** Variable is entered as 28-quarter distributed lag, fit to a third-degree polynomial with far endpoint constraint. Reported coefficient and t-statistic are for the sum of lag coefficients.

Putty-Putty

$$Inrst = \underset{(0.191)}{-0.448} + \underset{(2.860)}{0.093\, Knrst_{t-1}} + \underset{(2.546)^{*}}{8.248^{*}\,[(Y/cnrst) - (Y_{t-1}/cnrst_{t-1})]}$$

R-bar2: .306 Durbin-Watson: 1.315
Sample period: 1965:3--1985:4
Estimated first-order autocorrelation coefficient: 0.936
* Variable is entered as 27-quarter distributed lag, fit to a third-degree polynomial with far endpoint constraint. Reported coefficient and t-statistic are for the sum of lag coefficients.

Definitions:

Inrst: Investment in nonresidential structures (MPS). a/
Knrst: Net stock of nonresidential structures (MPS).
Y: Gross corporate product (MPS).
Cnrst: Real user cost of capital for nonresidential structures (cents per dollar) (MPS).
Dnrst: Real depreciation rate for nonresidential structures (estimated in putty-putty equation as 0.093).

NOTE: All variables are in billions of 1982 dollars unless otherwise specified. Numbers in parentheses below coefficient values are t-statistics.

a. MPS indicates MIT-Penn-Social Science Research Council model databank.

Effects on Residential Investment

The Tax Reform Act contains a number of provisions that may affect residential investment. For individuals with owner-occupied homes, these include the reduction in statutory individual income tax rates, which decrease the tax-reducing effect of deductions for mortgage interest and property taxes. These provisions cause increases in the estimated user costs for owner-occupied homes, as shown in Figure 3. For other investors in housing, including many tax-shelterers, these provisions include the reductions in both individual and corporate statutory tax rates, the significant scaling back of depreciation allowances, the increases in tax rates on capital gains, and the limitations on deductibility of "passive losses" by limited partners in enterprises such as real-estate ventures.

The literature suggests more conclusively that increases in user costs, in and of themselves, may work to reduce residential investment more than

TABLE 2. GOODNESS-OF-FIT OF ALTERNATIVE INVESTMENT EQUATIONS (Standard error of estimate as percentage of mean of dependent variable)

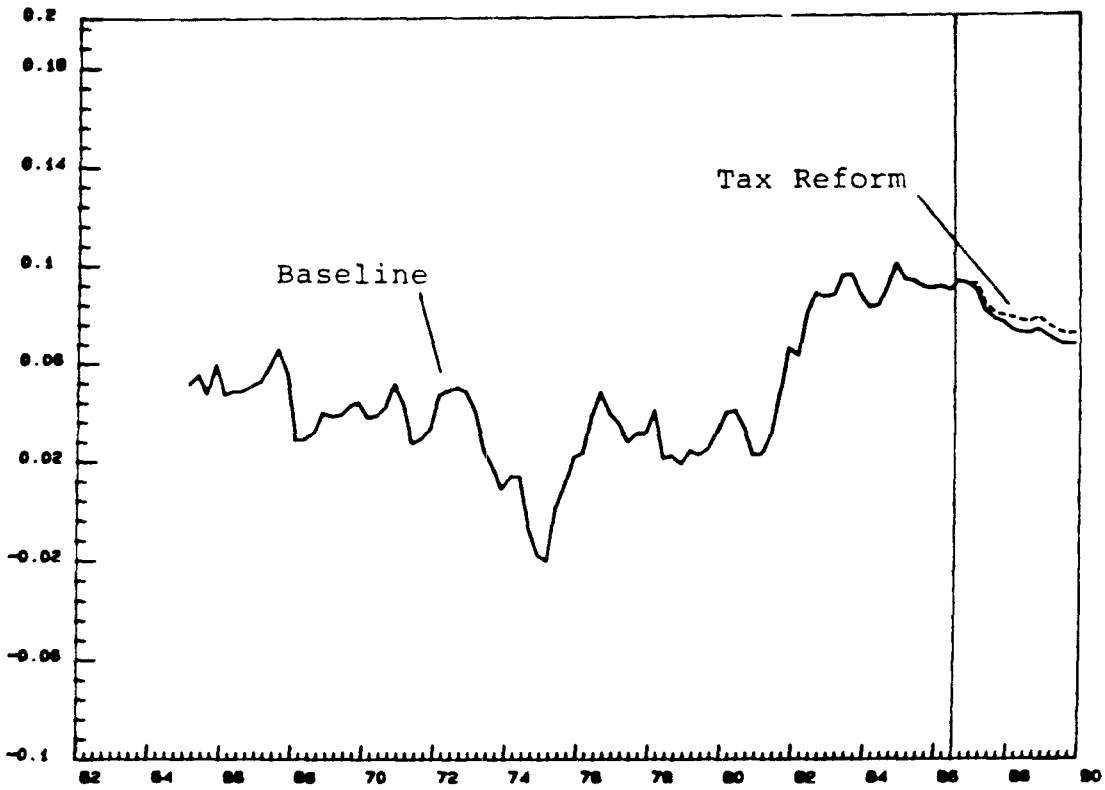
	Unadjusted for Serial Correlation	Adjusted
Accelerator		
Equipment	3.93	2.46
Structures a/	7.18	2.31
Putty-Putty		
Equipment	8.81	3.04
Structures a/	9.00	3.09
Putty-Clay		
Equipment	5.39	2.59
Structures a/	13.53	3.32

Note: Equation estimates are those shown in Table 1.

a. Dependent variable in "structures" regressions was nonresidential structures; in the accelerator case it included utility structures, while in the neoclassical equations it excluded them.

Figure 3.

User Cost for Owner-Occupied Single-Family Homes



SOURCE: Congressional Budget Office.

is the case with nonresidential investment. (As will be suggested below, however, the effects of the Tax Reform Act are likely to be concentrated in multiple-family housing rather than in single-family construction.) A few previous studies have approached the demand for housing services or housing starts using user costs explicitly in an unrestricted form with considerable success. 12/ Moreover, among the many other empirical housing studies there is virtually unexceptioned success in relating demand to the mortgage rate, with broadly similar quantitative results. 13/ While the mortgage rate is not the same as the user cost, the two are highly correlated. In studies of business fixed investment, by contrast, there has apparently been little success in relating demand either to interest rates or to user costs in unrestricted specifications.

If there is a depressing effect on housing from this increase in user costs, it is likely to be concentrated on multiple-family rather than single-family housing. Most studies on this subject emphasize that single-family housing starts depend on the user cost for owner-occupied single-family houses relative to that for rental housing. The rental price of rental housing, in turn, is proxied by that on multifamily housing. Calculations using an equation developed by Esaki and Wachtenheim suggest that single-family starts may rise slightly in response to the Tax Reform Act because the act increases the user cost of multifamily structures more sharply than that of single-family houses. 14/

Even if changes in user costs do have the partial effect of reducing residential investment, the Tax Reform Act may also have the partial effect of working to increase housing investment by increasing the disposable incomes of households. This study takes account of both the user-cost and the income effects by using the residential-investment equation from the MPS econometric model, which incorporates both effects,

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12. See, for example, Patric H. Hendershott, "Real User Costs and the Demand for Single-family Housing," *Brookings Papers on Economic Activity*, 1980:2, pp. 401-452.

13. A survey is provided in James Kearl, Kenneth Rosen, and Craig Swan, "Relationships Between the Mortgage Instruments, the Demand for Housing, and Mortgage Credit: A Review of Empirical Studies," in *New Mortgage Designs for an Inflationary Environment* (Boston: Federal Reserve Bank of Boston, 1975).

14. Howard Esaki and Judy Wachtenheim, "Explaining the Recent Level of Single-Family Housing Starts," *Federal Reserve Bank of New York Quarterly Review* (Winter 1984-85), pp. 31-38.

and which deals with both single- and multiple-family housing. 15/ The current version is:

$$QEH = 0.440 - 6.531 \log[(KH1 + KH5)/N]_{t-1} - 0.054\,RMEFF$$
$$+ 7.531 \log[0.125(\text{sum}_{i=0 \text{ to } 7}\, CON_{t-i})]/N$$
$$- 0.047^{**}[(0.75 \log cho) + (0.25 \log chr)]$$
$$- 0.043[U - U_{t-1}] - 0.156^{**}\,DCR.$$

**Variable is entered as a 4-quarter distributed lag, fit to a second-degree polynomial with near and far endpoint constraints. Reported coefficient is the sum of the lag coefficients.

Definitions:

QEH: Log of real per capita nonsubsidized housing expenditure.
KH1: Stock of one to four-family houses.
KH5: Stock of multifamily (five or more) houses.
N: Population (millions).
RMEFF: Effective nominal mortgage rate, MPS model definition.
CON: Consumption, MPS model definition.
cho: User cost for owner-occupied houses (cents per dollar).
chr: User cost for rental housing (assumed in simulations to be the user cost for nonresidential structures owned by corporations shown in Figure 2 above; measured in cents per dollar).
U: Civilian unemployment rate (percent).
DCR: Credit-rationing dummy.

This equation implies that investment is negatively related to a weighted average of the user costs for single- and multiple-family structures, as well as to the nominal mortgage rate. The long-run elasticity of expenditure with respect to the mortgage rate, which is reached after four quarters, is approximately 1.3. The equation also holds residential investment to be positively related to nondurable consumption, which in turn is related to disposable income. These properties appear to accord well with consensus views. 16/

15. For a discussion of this and other equations of the MPS model, see Flint Brayton, and Eileen Mauskopf, The MPS Model of the United States Economy, (Washington, D.C.: Board of Governors of the Federal Reserve System, 1985).

16. See Kearl, Rosen, and Swan, op. cit.

Consumer Durables

The implications of the tax legislation for spending on consumer durables are similar to those for housing: the tax change acts to reduce spending by increasing the user cost, but it may also act to stimulate spending by increasing the after-tax incomes of consumers. The increase in the user cost comes about because the act first reduces, and ultimately eliminates, the tax deductibility of interest on consumer loans, and because it eliminates the deductibility of state and local sales tax on such purchases. An estimate of the increase in the user cost for consumer-owned automobiles is shown in Figure 4. 17/

This study developed estimates of the overall effect of the legislation on durables spending using modified forms of equations developed by Mishkin. 18/ In the versions that are used here, which are shown below, these equations take account of the conflicting effects of the bill by relating durables spending to a user cost and to expected permanent and transitory disposable personal income. 19/

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17. This study has not attempted to measure the user-cost effect of the fact that interest on consumer credit remains deductible if secured by real estate. As a result, the increase in the average user cost portrayed in the figure is somewhat overstated.

    In the longer term, the user cost could also be changed by differences in the cost of production of consumer durable goods that are brought about by the tax reform. Such changes are, however, assumed not to occur within the short-run perspective to which the present analysis is confined.

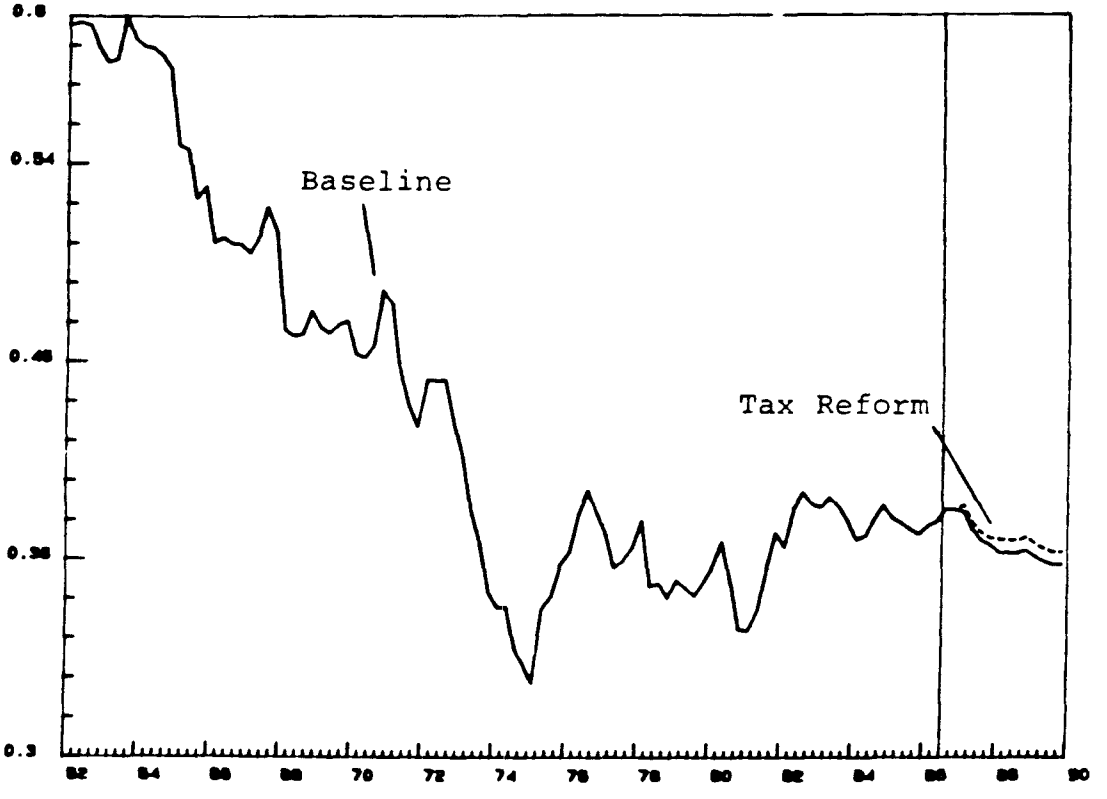
18. Frederic Mishkin, "Illiquidity, Consumer Durable Expenditure, and Monetary Policy," *American Economic Review* (September 1976), pp. 642-654.

19. Instrumented values of DBT, ASF, (YP x cc), and (YP x co) were used in the regressions (making the estimates shown two-stage least squares estimates). The instruments were current and lagged values of the discount rate (Federal Reserve Bank of New York), nonborrowed reserves, federal purchases, exports, the population 16 and over (all of which are in the MPS model databank), and the estimated marginal tax rate.

    Values of permanent and transitory disposable real per-capita personal income were derived as follows: real per capita personal income (MPS) was fitted to a third-order autoregressive process. Before-tax permanent and transitory real per-capita personal income were then taken to be given, respectively, by the fitted values and the residuals of this equation. These were converted to disposable values by multiplying them both by 1 minus the estimated average tax rate. This tax rate, then, is taken to be deterministic and subject to static expectations. The average tax rate is given by federal individual income tax liabilities plus state and local individual income tax liabilities (both MPS) divided by adjusted gross income (MPS). The marginal tax rate is taken to be 1.5 times the average tax rate.

Figure 4.

User Cost for Consumer Automobiles



SOURCE: Congressional Budget Office.